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Claims

[c1] What is claimed is:

1. A method of forming a material film, comprising:
providing a chemical vapor deposition (CVD) chamber comprising therein a showerhead coupled to a gas source and a pedestal coupled to a heater, wherein said showerhead is further coupled to a radio frequency (RF) power source;
positioning a substrate on said pedestal;
heating said substrate by said heater;
flowing a tantalum-containing organic metal precursor gas into said CVD chamber through said showerhead with said RF power source being off, thereby depositing a material film on said heated substrate;
thereafter turning on said RF power source to output a RF power;
flowing an inert gas into said chamber;
in-situ plasma treating said material film within said CVD chamber by providing said RF power to said inert gas; and
removing said substrate out of said CVD chamber.

[c2] 2. The method of forming a material film according to

claim 1 wherein said substrate is heated to a temperature of 200~600℃ by said heater.

[c3] 3. The method of forming a material film according to claim 1 wherein said substrate is heated to a temperature of 200~300℃ by said heater.

[c4] 4. The method of forming a material film according to claim 1 wherein said tantalum-containing organic metal precursor comprises pentakis(dimethylamido) tantalum (PDMAT) ($Ta(N(Me)_2)_5$) and pentakis(diethylamido) tantalum (PDEAT) ($Ta(N(Et)_2)_5$).

[c5] 5. The method of forming a material film according to claim 1 wherein said inert gas comprises argon (Ar).

[c6] 6. The method of forming a material film according to claim 1 wherein the step of in-situ plasma treating said material film uses argon plasma.

[c7] 7. The method of forming a material film according to claim 1 wherein said RF power is between 50~1000 Watts.

[c8] 8. The method of forming a material film according to claim 1 wherein said CVD chamber is further coupled to a vacuum pump.

[c9] 9. The method of forming a material film according to

claim 1 wherein said material layer is tantalum nitride layer.

[c10] 10. The method of forming a material film according to claim 1 wherein said material layer is tantalum layer.

[c11] 11. A method of forming a tantalum nitride film, comprising:
providing a chemical vapor deposition (CVD) chamber comprising at least therein a showerhead coupled to a gas source and a pedestal coupled to a heater, wherein said showerhead is further coupled to a first radio frequency (RF) power source;
positioning a substrate on said pedestal;
heating said substrate by said heater;
flowing a tantalum-containing organic metal precursor gas into said CVD chamber through said showerhead with said first radio frequency (RF) power source being off, thereby depositing a tantalum nitride film on said heated substrate;
thereafter turning on said first RF power source to output a first RF power;
flowing an inert gas into said chamber;
in-situ plasma treating said tantalum nitride film within said CVD chamber by providing said first RF power to said inert gas; and
removing said substrate out of said CVD chamber.

[c12] 12. The method of forming a tantalum nitride film according to claim 11 wherein said substrate is heated to a temperature of 200~600℃ by said heater.

[c13] 13. The method of forming a tantalum nitride film according to claim 11 wherein said substrate is heated to a temperature of 200~300℃ by said heater.

[c14] 14. The method of forming a tantalum nitride film according to claim 11 wherein said tantalum-containing organic metal precursor comprises pentakis(dimethylamido) tantalum (PDMAT) ($Ta(N(Me)_2)_5$) and pentakis(diethylamido) tantalum (PDEAT) ($Ta(N(Et)_2)_5$).

[c15] 15. The method of forming a tantalum nitride film according to claim 11 wherein said pedestal is further coupled to a second RF power source.

[c16] 16. The method of forming a tantalum nitride film according to claim 15 wherein said second RF power source outputs a second RF power of 0~1000 Watts.

[c17] 17. The method of forming a tantalum nitride film according to claim 15 wherein said second RF power source is off during said deposition of said tantalum nitride film.

[c18] 18. The method of forming a tantalum nitride film according to claim 11 wherein said inert gas comprises argon (Ar).

[c19] 19. The method of forming a tantalum nitride film according to claim 11 wherein the step of in-situ plasma treating said tantalum nitride film uses argon plasma.

[c20] 20. The method of forming a tantalum nitride film according to claim 11 wherein said first RF power is between 50~1000 Watts.

[c21] 21. The method of forming a tantalum nitride film according to claim 11 wherein said CVD chamber is further coupled to a vacuum pump.

[c22] 22. The method of forming a tantalum nitride film according to claim 11 wherein prior to the step of flowing said tantalum-containing organic metal precursor gas into said CVD chamber said method further comprising:
flowing a nitrogen-containing gas into said CVD chamber;
shutting down said flow of said nitrogen-containing gas; and
purging said CVD chamber with inert gas.

[c23] 23. The method of forming a tantalum nitride film ac-

cording to claim 22 wherein said nitrogen-containing gas is ammonia gas.